

WHAT IS CLAIMED IS:

1. A method of generating an interpolation image comprising:

5       dividing a first image into a plurality of first blocks;

          searching a second image for a second block having a strong correlation with respect to one of the first blocks every first block;

10       deriving a first motion vector between the first block and the second block;

          extracting a first sub block and a second sub block from the first block, the first sub block including pixels that an absolute difference value is less than a threshold, the second sub block including  
15       pixels that the absolute difference value is not less than the threshold, the absolute difference value being an absolute difference value between opposite pixels of the first block and the second block;

          searching for a third sub block in a region on  
20       the second image, the third sub block having a strong correlation with respect to the second sub block, the region corresponding to a region that the absolute difference value is not less than the threshold;

          deriving a second motion vector between the second  
25       sub block and the third sub block; and

          copying the first sub block and the second sub block onto a third image between the first image and

the second image, using the first motion vector and the second motion vector.

2. The method according to claim 1, wherein searching for the second block includes computing the absolute difference value between opposite pixels of each of a plurality of block candidates of the second image and the first block every pixel, counting pixels that the absolute difference value is less than the threshold to obtain the number of pixels, and selecting as the second block one of the block candidates in a search range that the number of pixels is maximum.

3. The method according to claim 1, wherein searching for the third sub block includes computing second absolute difference value between opposite pixels of the second sub block and each of a plurality of sub block candidates of the second image, counting pixels in the region that the second absolute difference value is less than second threshold to obtain the number of pixels, and selecting as the third sub block one of the sub block candidates in a search range that the number of pixels is maximum.

4. The method according to claim 2, wherein the absolute difference value is a first absolute different value and the threshold is a first threshold, and searching for the third sub block includes:

computing a second absolute difference value of opposite pixels between each of a plurality of sub

block candidates of the second image and the second sub block every pixel;

counting pixels in the first region that the second absolute difference value is less than a second threshold to obtain the number of pixels;

counting pixels in the second region on the second image that the first absolute difference value is less than the first threshold and the second absolute difference value is less than second threshold to obtain the second number of pixels; and

selecting as the third sub block one of the second sub block candidates that sum of the number of pixels and the second number of pixels is maximum in a search range.

5. The method according to claim 4, wherein the second threshold is smaller than the first threshold.

6. The method according to claim 4, wherein the copying includes copying onto the third image the pixels of the first sub block, a first group of pixels in the first region that the second absolute difference value is less than the second threshold, and a second group of pixels in the second region on the second image that the first absolute difference value is less than the first threshold and the second absolute difference value is not less than the second threshold.

7. The method according to claim 6, wherein the copying includes:

obtaining a scale conversion factor by dividing a first time period between the third image and the second image by a second time period between the first image and the second image,

5           obtaining a third motion vector by multiplying the first motion vector by the scale transfer coefficient,           obtaining a forth motion vector by multiplying the second motion vector by the scale transfer coefficient,           copying pixels of the first sub block onto the  
10           third image based on the third motion vector, and           copying, onto the third image, pixels belonging to the first group of pixels and the second group of pixels based on the fourth motion vector.

8. The method according to claim 1, wherein the  
15           copying includes obtaining a fourth sub block by           subjecting the second sub block and the third sub block to weighted average, and copying the first sub block and the fourth sub block onto the third image, using the first motion vector and the second motion vector.

20           9. The method according to claim 1, wherein the copying copies a fourth sub block and the third sub block onto the third image, the fourth sub block being on the second block and corresponding to the first sub block.

25           10. A method of generating an interpolation image comprising:

dividing an interpolation image between a first

image and a second image into a plurality of to-be-interpolated blocks;

5        searching for the first block of the first frame and the second block of the second frame, the first block and the second block being in alignment with the to-be-interpolated blocks and having a strong correlation to each other;

       deriving a first motion vector between the first block and the second block;

10       extracting a first sub block and a second sub block from the first block, the first sub block including pixels that an absolute difference value between opposite pixels of the first block and the second block is less than a threshold, the second sub  
15       block including pixels that the absolute difference value is not less than the threshold;

       extracting from each of the first image and the second image a region including pixels that the absolute difference value is not less than the  
20       threshold;

       searching for a third sub block of the region of the first image and a fourth sub block of the region of the second image, the third sub block and the fourth sub block being in alignment with the to-be-  
25       interpolated blocks and having a strong correlation with respect to each other;

       deriving a second motion vector between the third

sub block and the fourth sub block; and

copying the first sub block and the third sub block onto the interpolation image, using the first motion vector and the second motion vector.

5           11. The method according to claim 10, wherein searching for the first block and the second block includes:

          computing an absolute difference value between opposite pixels of the first block candidate of the first frame and the second block candidate of the second frame every pixel,

          counting pixels that the absolute difference value is less than the threshold to obtain the number of pixels;

15           selecting as the first block the first block candidate that the pixel number is maximum in a search range, and

          selecting as the second block the second block candidate that the pixel number is maximum in a search range.

20           12. The method according to claim 10, wherein searching the third sub block and the fourth sub block includes:

          computing a second absolute difference value between opposite pixels of the third sub block candidate of the first image and the fourth sub block candidate of the second image every pixel;

counting pixels that the second absolute  
difference value is less than the second threshold,  
with both of the pixels less than the threshold and the  
pixels not less than the threshold existing in the  
5 region, to obtain the number of pixels;

selecting as the third sub block the third block  
candidate that the number of pixels is maximum in a  
search range; and

selecting as the fourth sub block the fourth block  
10 candidate that the number of pixels is maximum in a  
search range.

13. The method according to claim 10, wherein  
searching for the third sub block and the fourth sub  
block includes:

15 computing a second absolute difference value  
between opposite pixels of a third sub block candidate  
of the first image and a fourth sub block candidate of  
the second image every pixel;

counting pixels of pixel pairs that the second  
20 absolute difference value is less than the second  
threshold, with both of the pixels less than the  
threshold and the pixels not less than the threshold  
existing in the region, to obtain the first number of  
pixels;

25 counting pixels of pixel pairs that the second  
absolute difference value is less than the third  
threshold, with the pixels less than the threshold or

the pixels not less than the threshold existing in the region, to obtain the second number of pixels;

counting pixels that the second absolute difference value is less than the fourth threshold,

5 with no pixel less than or not less than the threshold existing in the region, to obtain the third number of pixels; and

selecting a sub block pair of the third sub block candidate and the fourth sub block candidate that a sum  
10 of the first number of pixels, the second number of pixels and the third number of pixels is maximum in a search range as the third sub block and the fourth sub block.

14. The method according to claim 13, which  
15 includes selecting a region corresponding to the interpolation sub block in the third block as a third sub block, and selecting a region corresponding to the interpolation sub block in the fourth block as a fourth block.

20 15. An apparatus to generate an interpolation image, comprising

an input unit configured to input a first image and a second image;

a division unit configured to divide the first  
25 image into a plurality of first blocks;

a first motion vector detection unit configured to detect a first motion vector by searching the second

image for a second block with a strong correlation with respect to one of the first blocks every first block;

an extraction unit configured to extract from the first block a first sub block and a second sub block,  
5 the first sub block including pixels that an absolute difference value between opposite pixels of the first block and the second block is less than a threshold, and the second sub block including pixels that the absolute difference value is not less than the  
10 threshold;

a second motion vector detection unit configured to detect a second motion vector by searching a region on the second image that the absolute difference value is not less than the threshold for a third sub block  
15 with a strong correlation with respect to the second sub block; and

an interpolation image generation unit configured to generate an interpolation image by copying the first sub block and the third sub block onto a third frame  
20 between the first image and the second image, using the first motion vector and the second motion vector.

16. The apparatus according to claim 15, wherein the first motion vector detection unit comprises:

an absolute difference value computation unit  
25 configured to compute the absolute difference value between the opposite pixels of a second block candidate of the second image and the first block;

a count unit configured to count pixels that the absolute difference value is less than the threshold to obtain the number of pixels; and

5 a selection unit configured to select as the second block the second block candidate that the number of pixels is maximum in a search range.

17. The apparatus according to claim 16, wherein the second motion vector detection unit comprises:

10 a second absolute difference value computation unit configured to compute a second absolute difference value between opposite pixels of a third sub block candidate of the second image and the second sub block;

a count unit configured to count pixels in the region that the second absolute difference value is  
15 less than the second threshold to obtains the number of pixels; and

a second selection unit configured to select as the third sub block the third sub block candidate that the number of pixels is maximum in a search range.

20 18. The apparatus according to claim 16, wherein the second motion vector detection unit comprises:

a second absolute difference value computation unit configured to compute a second absolute difference value between opposite pixels of a third sub block  
25 candidate of the second image and the second sub block;

a second count unit configured to count pixels in the region that the second absolute difference value is

less than the second threshold to obtain the first number of pixels;

5 a third count unit configured to count pixels in a second region on the second image that the absolute difference value is less than the first threshold, the pixels being pixels that the second absolute difference value is not less than the third threshold, to obtain the second number of pixels; and

10 a second selection unit configured to select as the third sub block the third sub block candidate that sum of the first number of pixels and the second number of pixels is maximum in a search range.

19. An image display method comprising:

inputting an input image;  
15 generating an interpolation image according to the method of claim 1; and  
displaying selectively the input image and the interpolation image.

20. An image display system comprising:

20 an image input unit configured to input an input image;  
the apparatus to generate an interpolation image, according to claim 15; and  
a display device to display selectively the input  
25 image and the interpolation image.